MATHEMATICAL DARWINISM

A Discussion of the Genetical Theory of Natural Selection*

By Professor J. B. S. HALDANE

SCIENTIFIC books of permanent value may be divided into two classes. On the one hand are the text-books which summarize a branch of science so as to render it accessible to a new group of readers or clarify its principles. On the other are books which, though often inaccurate in detail, state a new point of view, and lay the foundations of new branches of science. The book before us is of the latter class. It is extremely difficult and highly controversial. Nevertheless it lays down methods by which the problem of evolution, including the present evolution of man, can be discussed with a certain measure of precision. No serious future discussion either of evolution or eugenics can possibly ignore it.

The first five chapters are mathematical, though the conclusions are given in non-mathematical language. The first chapter is of great historical interest, because it shows why Darwin, who believed in the blending theory of inheritance, was logically forced to postulate external causes of heritable variation—and why in the light of our present knowledge, blending inheritance cannot account for any appreciable fraction of observed variation, so that this necessity no longer arises. The next four chapters deal with the effects of selection on populations whose variance is determined by a large number of Mendelian genes. The reasoning is often very difficult, and I believe in at least two cases erroneous, though the errors do not affect the general conclusions of the book. The argument, like all mathematical arguments, is hypothetical. That is to say, it discusses the results which must follow from certain premisses. Nevertheless it would perhaps have had more cogency for the average reader had it been more copiously illustrated by available facts. For example, the views developed in Chapters IV and V would have carried more conviction had reference been made to the author's own proof that Pearson and Lee's data on the inheritance of human stature agree very well with the theory here developed. And reference could with advantage have been made to the quantitative work of Pissarev, Sukatchev, and others on natural selection in cultivated and wild plants.

Perhaps the most sensational and unexpected conclusion which emerges from the mathematics is that selection for a quantitative character may cause a population to go on changing in the direction for which selection has taken place, even after that selection has stopped. We have, therefore, an entirely novel explanation of the apparently useless cases of orthogenesis which seem to be shown in the geological record. The sixth and seventh chapters deal with sexual selection and mimicry. The treatment is less mathematical, and it is possible that some of the arguments would prove to be invalid were they stated in mathematical terms.

But when all such criticisms have been made, it becomes fairly clear that during the next generation any discussions of the problem of gradual evolution which are likely to be of permanent value will take the form of a development, discussion, and perhaps in some cases a refutation, of the arguments stated in the book before us. To quote the author's preface, " It seems impossible that full justice should be done to the subject in this way, until there is built up a tradition of mathematical work devoted

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* Fisher, R. A., Sc.D., F.R.S. *The Genetical Theory of Natural Selection.* Oxford, 1930. Clarendon Press. This book was reviewed in the EUGENICS REVIEW of July 1930.

to biological problems, comparable to the researches upon which a mathematical physicist can draw in the solution of special difficulties."

One important caution must be added. In the course of evolution there have certainly been sudden changes, for example changes of chromosome number, and in all probability the formation of new species by hybridization. Dr. Fisher's theory takes little or no account of these, and for this reason cannot be regarded as a full account of evolution by natural selection.

The last five chapters will be of most interest to readers of this journal. The attempt is made to explain the fact that all civilizations previous to our own have decayed. Very strong evidence is brought forward that the main cause of changes in the composition of human populations is the difference in effective fertility between different genotypes. It is further argued that the most important heritable causes of such difference are differences of moral temperament. Hence selection has tended in the past to eliminate the type of human character which favoured infanticide and abortion. The variation of fertility in relation to social class is examined, though we miss any reference to the very remarkable and perhaps significant state of affairs in Stockholm, where the poor are breeding no faster than the rich.

So far most members of the Eugenics Society will be in agreement with Dr. Fisher. His last two chapters are likely to raise a good deal of opposition. He regards the social promotion of infertility as the main cause of the differential birth rate. The argument, which is at times rather subtle, is essentially a development of Galton's demonstration that marriage with heiresses, who are rich owing to the infertility of their parents, is a potent cause of the extinction of families.

His suggested remedy for the dysgenic character of civilized societies is a very thorough-going system of family allowances on such a scale that infertility would no longer be a cause of social promotion. The reviewer considers that he has made out an extremely strong case. Indeed, if his biological facts are correct it is probable that a socialistic state in which no wealth was inherited would be more eugenic than our present society, and it is a little difficult to see why Dr. Fisher's economic views are not even more radical.

It is clear that Dr. Fisher's opinions are opposed to those of many believers in eugenics. The immediate effects of such a system as he proposes would probably be to increase the fertility of some sections of the poorer classes, for, as he himself admits, it would be extremely difficult to apply it to the small but, on the whole, intelligent section of the population which is not in receipt of fixed wages or salaries, but rewarded by fees from many different sources. Hence the first result of such a system might be the opposite of eugenic.

The following criticisms of Fisher's social theory, among others, might be made. If the number of genes concerned in human intellectual ability is very large, the conditions in the bulk of the population are more important than those in the most intelligent and unintelligent groups. If, however, high intelligence on the one hand, and mental defect on the other, are due to rather few genes, as seems very possible, the eugenist may be justified in viewing those sections of the population in which those genes are concentrated with what would otherwise be an exaggerated interest.

Again, the arguments regarding the selection of moral dispositions will be rather weak until we know more about what is actually inherited. Dr. Fisher writes as if fanaticism were inherited as such. It seems more likely that the innate basis of fanaticism is a special type of suggestibility which may show itself as fanaticism in certain environments. Among the well-to-do classes to-day there is a great deal of rather unintelligent Malthusian propaganda. In fact there is something of a taboo against large families. Hence a large number of the parents of large families are people who, just because they think for themselves and react against mass suggestion, have not been affected by this propaganda. People of the

same mental make-up would probably have limited their families fifty years ago.

Nevertheless if Dr. Fisher is on the whole correct, civilization can only be saved by a very radical change of opinion and practice. And in particular much of the propaganda of eugenists will prove to have been misdirected. To quote his own words: "The reformer must expect to encounter deep-seated opposition in the classes on which he would naturally rely for an intelligent anxiety for the future of their country."

One conclusion is fairly clear. Before the eugenic movement commits itself on the one hand to the further encouragement of the social promotion of infertility, or on the other to subsidizing the breeding of undesirable groups, a really thorough investigation should be made of the causes of differential fertility. There can be no doubt of its existence or of its undesirability, but several opinions are possible as to the most hopeful method of combating it.

Dr. Fisher's book, then, must be read. But it is not easy reading. It is greatly to be hoped that within the next ten years the sections dealing with evolution and eugenics will both be rewritten in a form which demands less intellectual effort in its readers. Till then it is likely to remain the best discussion of its subjects so far written.

HENRY TWITCHIN

Some Notes on his Family History

By W. T. J. Gun, F.R.Hist.S., F.S.G.

I HAVE been asked to make some additions to the account of our benefactor by Major Darwin in the REVIEW for July 1930, and Mr. Leonard Jessop Fulton has very kindly supplied me with information that he collected some few years ago in connection with Mr. Twitchin's pedigree.

Nothing further has been ascertained with regard to the maternal family, the Lovelocks, nor with regard to the descent of the Northways, to whom the paternal grandmother belonged. It is to be noted, however, that on this side Henry Twitchin possessed a relative, Edward Northway Butt by name, who was in business as a chemist and acquired a considerable fortune. It is probably from the Northway strain that Henry Twitchin's business ability was mainly derived.

With regard, however, to the male line descent some interesting facts have been brought to light by Mr. Fulton. The direct ancestry cannot, it is true, be definitely traced back further than Henry's grandfather, Andrew Twitchin. The name Andrew is however significant, as it is frequently found to occur in conjunction with that of Twitchin in various individuals of the seventeenth and eighteenth centuries, yeomen farmers for the most part or men of similar status, residing in Berkshire or its immediate neighbourhood.

Having regard to this rather uncommon Christian name, and very uncommon surname, there can be little doubt that Henry's grandfather was descended from a certain Andrew Twitchin, of Inkpen in Berks, whose will was proved November 22nd,